A Plan for Updating and Testing the North Dakota Department of Health's CALMET and CALPUFF Protocol

DRAFT FINAL

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BACKGROUND

The State of North Dakota (State) has primacy granted by the U.S. Environmental Protection Agency (EPA) under the Federal Clean Air Act (CAA) for administration of the CAA and implementing regulations in North Dakota. The State's Department of Health (Department), Environmental Health Section, has air quality management duties pursuant to primacy and State law, regulations and policy.

The state has designated Class I areas under the Prevention of Significant Deterioration (PSD) provisions of the CAA. The areas are: the Theodore Roosevelt National Park (TRNP) comprised of three non-contiguous land areas (South Unit, Elkhorn Ranch and North Unit) and the Lostwood Wilderness Area (LWA). Federal Land Managers (FLMs, i.e., the National Park Service (NPS) and the Fish and Wildlife Service (FWS), respectively) manage the resources of these CAA Class I areas.

The state's resources include several major sources of sulfur dioxide that are widely scattered across central and western regions of the state and numerous minor sources that are within close proximity (less than 50 km) of Class I areas. The state's resources also include data obtained with monitors that represent actual ambient concentrations of sulfur dioxide at locations in these areas and at other locations.

Sulfur dioxide concentrations at monitoring locations in the South and North Units of TRNP peaked during 1983 in the South Unit and during 1982 in the North Unit.[1] The concentrations have declined since then due to reductions in the sulfur dioxide emissions by oil-gas production followed by reductions in emissions by coal combustion during the 1990s. The sulfur dioxide second-highest 24-hour and 3-hour concentrations during years 2006 through 2008 are shown in Attachment A.

In addition to ambient monitoring, computer models are tools used to predict the impacts of pollutants emitted by proposed sources or to estimate the impacts of existing sources on ground level air quality. An air quality modeling protocol includes: the model or models, all model input data including user settings for technical options, meteorology and sources' emissions rates and locations, execution of the model(s) using the input data, procedures for tabulation of model-based estimates of ambient concentrations, and other execution issues.

The Department's current long-range transport protocol (hereafter the *MOU Protocol*)[2] was completed early in 2004, and the State Health Officer's Findings and Conclusions in 2005 declared this protocol as the guideline protocol for future long-range transport modeling.[3]

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[1] See CAA § 110(a)(2)(B), which requires a State Implementation Plan (SIP) that provides for monitoring ambient air quality. The Department's Quality Assurance Project Plan for its monitoring network is periodically reviewed by EPA. Data collected by the monitors are a) summarized in annual reports and b) provided to EPA. Monitoring data collected at all locations reflect emitted pollutants from all near and far mobile sources and near and far, short stack and tall stack, stationary sources.

[2] See *North Dakota's SO2 PSD Air Quality Modeling Report*, § 1.0 and Addenda A, B and I.

The Department's *MOU Protocol* uses EPA's Calmet and Calpuff models; Calmet is a diagnostic meteorological model, and Calpuff is a long-range air quality model. Calmet and Calpuff are executed in tandem; Calmet's output, along with other input, is required by Calpuff. Meteorological, emissions and other model input data used in the *MOU Protocol* are dated to years 2000 through 2002.

Although EPA gave verbal approval of the Department's *MOU Protocol* in April 2004 and written, unconditional preliminary approval of the protocol in June 2005, a few protocol issues recurred through 2008 and into 2009.

Aspects of the legal, regulatory and technical background for the *MOU Protocol* are described in several Department documents.[4] Applicable laws, regulations, preambles to regulations, guidance, and the *Alabama Power* court case (see *Alabama Power Co. v. Costle*, 636 F.2d 323 (D.C. Cir. 1979)), are not prescriptive for many aspects of modeling protocols and, so, implicitly, if not explicitly, allow extensive user discretion applicable to local circumstances.[5]

The purposes of this plan are:

P1. To update the *MOU Protocol* into a new Calmet-Calpuff protocol (hereafter the *2009 Protocol*).

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[3] See the CAA § 165 (e)(3)(D), which states that a model designated under EPA regulations "may be adjusted upon a determination, after notice and opportunity for public hearing, that such adjustment is necessary to take into account unique terrain or meteorological characteristics of an area potentially affected by emissions from a source applying for a permit." See also the Department's *Periodic Review hearing relating to North Dakota's Sulfur Dioxide (SO2) Prevention of Significant Deterioration (PSD) Air Quality Modeling Report to the United States Environmental Protection Agency (DRAFT FINAL October 29, 2004). Recommendations of the Hearing Officer to the State Health Officer of Proposed Findings and Determination*, § 6.5. The Findings and Determination were adopted and approved September 7, 2005, by the State Health Officer.

[4] See *North Dakota's SO2 PSD Air Quality Modeling Report*, Addenda A through I, *Comments by the North Dakota Department of Health and the State of North Dakota on EPA'S Proposed Rule Revisions* in a letter by Terry O'Clair, Director, Division of Air Quality, NDDH, and dated August 6, 2007, to Stephen L. Johnson, EPA Administrator, Environmental Protection Agency, and *Supplemental Comments by the North Dakota Department of Health and the State of North Dakota on EPA'S Proposed Rule Revisions* in a letter by Terry O'Clair, Director, Division of Air Quality, NDDH, and dated September 28, 2007, to Stephen L. Johnson, EPA Administrator, Environmental Protection Agency.

[5] This plan reflects provisions of the Federal CAA, EPA's implementing regulations, EPA's preambles to implementing regulations, EPA's guidance, *Alabama Power*, and State law, regulations and policy regarding the following subjects: baseline concentration; PSD increments and variances via FLM Certifications of No Adverse Impact; emission rates; ambient monitoring of actual concentrations; choice of models, model input data including meteorology; and model performance accuracy. A few of these provisions are prescriptive, such as the CAA's PSD primary increments and alternate increments, the CAA's required ambient air quality monitoring, and the CAA's technology forcing objective as discerned by *Alabama Power*; but other provisions are not.

P2. Using the *2009 Protocol*,[6] to complete a new periodic review of the status of consumption, or expansion, of the sulfur dioxide PSD Class I area short-term increments (see 40 CFR § 51.166(a)(4)).

Consumption occurs when the second-highest short-term concentration during recent years (current period or period of concern) is larger than the baseline concentration (see 40 CFR § 51.166(b)(13)),[7] which generally is the second-highest concentration at the time of (or one year preceding) the PSD minor source baseline date. Expansion occurs when the second-highest concentration during recent years is less than the baseline concentration.

GENERAL STRATEGY

During the last decade, several Calmet-Calpuff protocol issues recurred. The issues related to provisions of the CAA and implementing regulations and to choices for, and construction of, modeling techniques and input data for Calmet and Calpuff. These issues were described or refuted by the State (e.g., Office of the Attorney General) and the Department,[8] EPA, FLMs, affected industries and/or interested external organizations. Although Department public comment periods and hearings on issues were held in 2002, 2003 and 2005 and EPA gave written, unconditional approval in 2005, consensus on some issues has not occurred.

EPA and FLMs have oversight authority or obligations for review of the State's and the Department's administration of the CAA. Since 2001-02, they have changed their preferences for some protocol techniques and some input data, such as values or settings for Calmet and Calpuff execution control variables.[9] While doing so, EPA and FLMs often inferred that the

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[6] Historically, the Department used three draft Calmet-Calpuff protocols; one in 1999, one in 2002, and another in 2003. EPA used two draft Calmet-Calpuff protocols; one in 2002 and another in 2003. See the Department's *Responses to Recurring Issues Related to North Dakota's Computer Modeling of Sulfur Dioxide in CAA PSD Class I Areas*, §§ 3.8, 3.9 and 3.10 and *North Dakota's SO2 PSD Air Quality Modeling Report*, Addendum I, §§ 2, 4 and 5.

[7] For a discussion of the baseline concentration, see *North Dakota's SO2 PSD Air Quality Modeling Report*, Addendum G, § 2.3. See also Addendum H, § 1.0.

[8] See footnote 4 and see, for example, the Department's *Responses to Recurring Issues Related to North Dakota's Computer Modeling of Sulfur Dioxide in CAA PSD Class I Areas*.

[9] In 2003, EPA adopted Calmet and Calpuff in its *Guideline on Air Quality Models* (GAQM) as its preferred long range transport and dispersion models. (68 FR (April 15, 2003) 18440) At that time, EPA stated: "Some comments suggested that the CALMET (meteorological preprocessor for CALPUFF) and CALPUFF options should be defined for a variety of specific situations. We believe that more experience is needed before specific guidance can be offered for the variety of applications envisioned that might use the CALPUFF modeling system. … When sufficient experience has been attained and it has become obvious what settings should be employed for best results for certain situations, we will promulgate expanded guidance after allowing opportunity for public review and comment." (Id. at 18442) The Department notes here that EPA has not proposed for public review and subsequently promulgated rules

Department's preferences for some input data were inappropriate for North Dakota when claiming that their preferences were instead appropriate for the state in the context of fostering national consistency irrespective of the state's resources.[10] The reasons for these preferences were often vague (lacking traceable technical reasoning).[11] In a departure, EPA accepted the Department's 2005 demonstration of model performance using the *MOU Protocol* as appropriate for the modeled dispersion and source configuration (see an email by Region 8 of EPA dated February 11, 2008). The Department notes that its performance results also represent the modeled source characteristics and emissions rates, topography, meteorology and other input data.

Now, new EPA and FLM preferences for some user chosen values or settings that govern the execution of the Calmet model are provided in an EPA memorandum that is dated August 31, 2009. The reasons for several of the new preferences are also vague, and as in the past, are not supported by *Alabama Power*'s required performance demonstrations using actual ambient monitoring data such as sulfur dioxide or other pollutant concentrations. This Department plan

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or guidance involving values or settings for specific situations, such as North Dakota's topography, meteorology, source configuration and source characteristics.

[10] However, EPA's guidance prompts use of model input data that are appropriate for the topography, meteorology, source configuration and source characteristics of the modeling domain.* See EPA's *Guideline on Air Quality Models* (70 FR (November 9, 2005) 68218), §§ 1.b, 1.c, 9.1.a, 9.1.3.a, 9.1.3.b, 10.1.b and A.4.a(3). EPA and FLMs are members of IWAQM. In spite of EPA's guidance, EPA and FLMs have resisted some aspects of the Department's *MOU Protocol* claiming this protocol departs from the CAA and from their aspirations for national consistency.** In the shadow of this claim is their intention that their technical approach (techniques and model input data) trump, without legal authority, the Department's protocol and demonstrations of model performance.*** Their intention tunes out the reality that the Department's protocol begins with an aerial domain for North Dakota and adjoining areas and then selects and performance tests the model inputs appropriate for this domain. (*EPA's latest GAQM does not include any text that discusses, or refers readers to, IWAQM's 1998 values or settings of Calmet and Calpuff execution control variables. **Applications of models have lacked consistency among EPA's ten regions. See, for example, EPA document number 587.4 in EPA docket EPA-HQ-OAR-2006-0888. ***See, for example, footnote 9 and *Comments by the North Dakota Department of Health and the State of North Dakota on EPA'S Proposed Rule Revisions* , pages 22 through 26, in a letter by Terry O'Clair, Director, Division of Air Quality, NDDH, and dated August 6, 2007, to Stephen L. Johnson, EPA Administrator, Environmental Protection Agency.)

[11] Thus, the Department does not know the technical reasons for many EPA or FLM preferred model input data such as values or settings for model execution control variables, and, so, the Department lacks those reasons when using EPA or FLM preferred data or when explaining reasons for its alternate input data. In any case, applied discretion in modeling becomes enforceable after the Department takes public comment, holds a hearing and issues findings pursuant to applicable requirements of the CAA, implementing regulations (the State has primacy) and the State's Administrative Procedures Act. Consequently, the burden for transparency (explaining technical reasons) for model input rests with a permit applicant or with the State and the Department, as may be necessary. See, for example, *North Dakota's SO2 PSD Air Quality Modeling Report*, §§ 1.0 and 3.0 through 3.8, and the Department's *Responses to Recurring Issues Related to North Dakota's Computer Modeling of Sulfur Dioxide in CAA PSD Class I Areas*, Part 4.

includes action tasks that provide new documentation for EPA and FLM review and for an independent peer review.

The Department's plan has two goals in concert with its two purposes.

G1. The first goal is to construct a new protocol for a North Dakota modeling domain that not only complies with the CAA, implementing regulations, and *Alabama Power* and reflects preambles to regulations, EPA's *Guideline on Air Quality Models* (Appendix W attached to 40 CFR Part 51) and State policy, but also applies responsible discretion in choices for model input data that is: a) appropriate for the topography, meteorology, source configuration and sources' emissions of central and western North Dakota, and b) adequately documented.

G2. The second goal is to improve and elevate an understanding, and therefore acceptance, of the new protocol by external parties prior to execution of that protocol for a new periodic review and for New Source Reviews (NSRs).[12]

MODEL AND MODEL INPUT DATA UNCERTAINTY

Models and most input data used when executing them have some uncertainty. Appropriate choices for input data that are suitable for the topography of central and western North Dakota can reduce uncertainty.[13] Greater accuracy in model input data, such as meteorology, can reduce, but not eliminate, uncertainty. In addition, algorithms that describe the diagnostic interpolations of the meteorology in Calmet and the physics of pollutant transport, dispersion, chemical transformation, and deposition in Calpuff include uncertainty. For example, the accuracy of modeled plume paths depends upon the accuracy of the four-dimensional wind fields as input to Calmet, the diagnostic interpolation of those wind fields by Calmet to the models' grid, and the transport and dispersion of plumes in those wind fields by Calpuff. Consequently, uncertainty in model algorithms and in model input data causes uncertainty in the accuracy of modeled concentrations.[14]

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[12] See EPA's *Guideline on Air Quality Models,* § 3.0(b).

[13] See the CAA, § 165 (e)(3)(D). After 2005, a revision to North Dakota Administrative Code (NDAC) § 33-15-15-01.2 was proposed and a public hearing was held. NDAC 33-15-15-01.2 now states that "technical inputs for these models shall be based upon credible data approved in advance by the department. In making such determinations, the department shall review such technical data to determine whether it is representative of actual source, meteorology, topographical or local air quality circumstances." This provision, which is in the North Dakota SIP, was approved by EPA and became effective August 20, 2007 (see FR 72 (July 19, 2007) 39564). See also EPA's *Technical Support Document for EPA SIP Action on the Submittal of the North Dakota Department of Health Air Pollution Control Rules 33-15-15*, which is dated November 2, 2006, and is document number 0005(1) in EPA's docket number EPA-R08-OAR-2006-0502, and see also EPA's *Guideline on Air Quality Models* (70 FR (November 9, 2005) 68218), §§ 1.c and A.4.a(3).

[14] EPA acknowledges that these uncertainties cause error and bias in model-based concentrations. See its *Guideline on Air Quality Models* (70 FR (November 9, 2005) 68218), §§ 9.1.1 (a) & (b).

This Department plan relies on actual ambient monitoring data of sulfur dioxide to illustrate uncertainty as error and bias in model-based estimates of sulfur dioxide concentrations.[15] It includes performance demonstrations of updated data inputs to Calmet and Calpuff. These demonstrations compare model-based estimates of sulfur dioxide concentrations to actual ambient sulfur dioxide concentrations, which have minimal uncertainty.[16]

EPA and FLM preferences for model input data, if applied in a Calmet-Calpuff protocol for a North Dakota domain, assume without demonstrations that protocol results represent a realistic projection of actual air quality. This plan also includes one performance test of a modified protocol that uses most EPA and FLM preferences for the values and settings for Calmet execution control variables and one additional performance test that adds their preference for Calpuff dispersion.

NSR COORDINATION

The last phase of this plan is completion of an updated periodic review of the status of attainment of the CAA's provisions for PSD relating to the sulfur dioxide PSD Class I area 24-hour and 3-hour increments. In addition, a review of the status of consumption of PSD

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[15] Error and bias are statistical expressions of the accuracy of modeled results. This plan reflects the CAA's § 165(e)(2) required monitoring of actual ambient concentrations in PSD areas and the CAA's § 110(a)(2)(K) requirement that a SIP provide for the performance of modeling used to assess the effect on ambient air quality of emissions. In 1978, EPA stated: "It is apparent that Congress included monitoring requirements as a means of checking the accuracy of the modeling results." (43 FR No. 188 (June 19, 1978) at page 26399) And in 1979, a federal court stated: "Though EPA has the authority to require methods other than monitoring in its effort to ensure that allowable increments and NAAQS are not violated, and though it may choose to invoke that authority because of its perception that monitoring alone is inadequate to the task, **it does not have the authority to dispense with monitoring as at least one element of the overall enforcement effort where Congress has mandated the use of that technique.**" (Emphasis added.) See *Alabama Power Co. v. Costle* at 636 F.2d 323, 372 (D.C. Cir. 1979). See also EPA's *Guideline on Air Quality Models* (70 FR (November 9, 2005) 68218), §§ 1.b, 9.1.a, 9.1.3.a, 9.1.3.b and 10.1.b, and *Supplemental Comments by the North Dakota Department of Health and the State of North Dakota on EPA'S Proposed Rule Revisions* , page 24 through 31, in a letter by Terry O'Clair, Director, Division of Air Quality, NDDH, and dated September 28, 2007, to Stephen L. Johnson, EPA Administrator, Environmental Protection Agency.

[16] See footnote 1. A federal court decision states: "**We discern from the statute a technology-forcing objective**. Congress intended that monitoring would impose a certain discipline on the use of modeling techniques, which would be the principal device relied upon for the projection of the impact on air quality of emissions from a regulated source. This projects that the employment of modeling techniques be held to earth by a continual process of confirmation and reassessment, a process that enhances confidence in modeling, as a means for realistic projection of air quality. This objective is furthered by the development of … monitoring techniques, and the collection of the data base that would result from monitoring's widespread use." (Emphasis added.) See *Alabama Power Co. v. Costle* at 636 F.2d 323, 372 (D.C. Cir. 1979).

increments generally occurs as an element of NSR.[17] So, the *2009 Protocol* also applies to future NSRs.

Applicants for air quality permits to modify a source or to construct a new source and their consultants are expected to comply with the CAA, implementing regulations and *Alabama Power* and with the Department's 2005 hearing findings and policies. Applicants are also expected to disclose departures from the Department's Calmet-Calpuff protocols and to provide adequate transparency that explains and justifies those departures.[18]

STRATEGIC AND TASK DETAILS

This plan contains six phases that include one or more task activities to achieve the two goals and two purposes. Time lines for each successive phase are additive to the sum of time lines for previous phases in determining anticipated net time through completion of each phase (see figure 1).

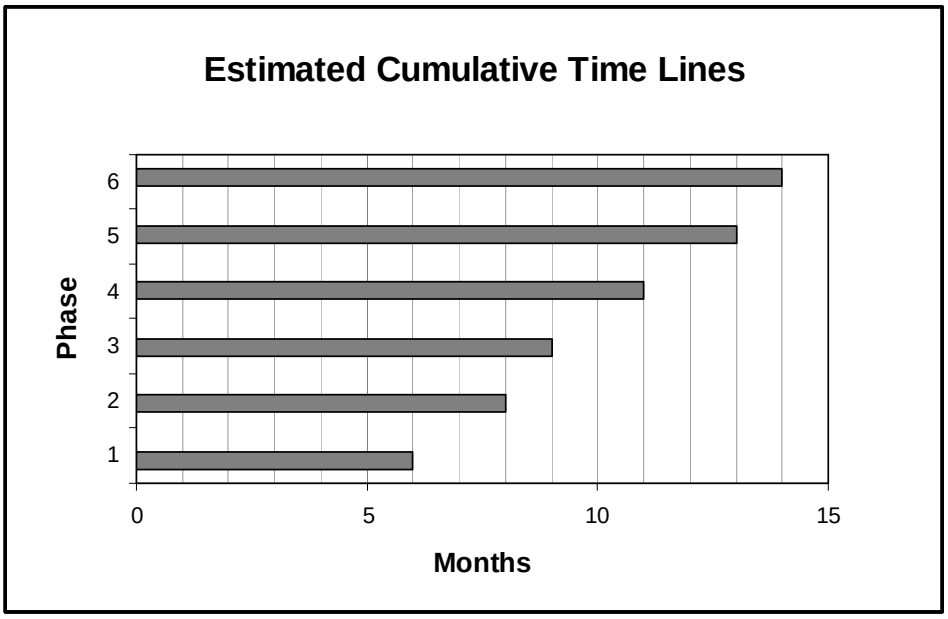

Figure 1.

First and Second Goals – First Purpose:

[17] Since 1978, the Department has completed reviews of the status of consumption of PSD Class I and Class II increments in conjunction with NSRs (see CAA § 165(a)(4)).

[18] See footnote 5. This plan's goals and actions do not preclude permit applicants from additional modeling using alternative techniques and input data, provided the applicants demonstrate that their alternative techniques and input data are technically more appropriate. See also footnotes 3, 7, 9, 11, 13, 15 and 16.

- Phase I – Assemble and document updated model input data for the *2009 Protocol*.
- Phase II – Execute the models using (a) the updated input data and, (b) as substitutions in the updated input data, EPA and FLM August 31, 2009, preferred values or settings for model execution control variables; and performance accuracy analyses of both (a) and (b) results.
- Phase III – Completion of remaining elements of the *2009 Protocol*. These elements carryover from the *MOU Protocol*. Phases I and III become the *2009 Protocol*.
- Phase IV – EPA and FLM review of I, II and III documentation.
- Phase V – Peer review (as an option) of I, II and III documentation; and State Office of Attorney General and Department review of IV comments and any peer reviewer comments, and then adjust the *2009 Protocol*, if appropriate.

First and Second Goals – Second Purpose:

- Phase VI – Using updated model input data and other inputs and methods comprising the *2009 Protocol*, complete a new periodic review of the status of consumption (or expansion) of the sulfur dioxide PSD Class I area 24-hour and 3-hour increments.

Phase I – Preparation of Input Data for the *2009 Protocol*

Estimated time line: six months.

A. Department's internal actions.

1. Calmet and Calpuff were included in EPA's *Guideline on Air Quality Models* in 2003 (see 68 FR (April 15, 2003) 18440). Current versions of these models that are endorsed by EPA will be used. EPA and FLMs are working toward replacing Calmet with another meteorological model; the time line for their objective is unknown. The Department's obligations by law and rule require proceeding with this plan rather than delaying a protocol update into the future until such time as the replacement for Calmet is available. However, if EPA adopts a Calmet replacement during the time frame of this Department plan, the Department will consider use of that replacement.

2. (a) The Department will conduct an internal review of values or settings for Calmet and Calpuff execution control variables, as well as the models' grid scale. Here and throughout this plan, "settings" refers to the switches that select which option for a specific function will be used, such as interpolation of observations to the models' grid by Calmet and dispersion by Calpuff.
(b) Then, it may consult with TRC's Atmospherics Studies Group[19] on applicable values or settings for some variables.

[19] TRC's Atmospherics Studies Group wrote the computer code for the technical algorithms in Calmet and Calpuff and is responsible for hosting EPA's approved versions of Calmet and Calpuff. TRC also has extensive experience in using these models. See http://www.src.com/calpuff/calpuff1.htm.

(c) Sensitivity tests are not performance accuracy tests, which quantify uncertainty. These tests generally evaluate the effects on a model's output data caused by options in the model's input data, including switch settings, by comparing model output to model output. No sensitivity testing of either model will be conducted using Phase I model input data, unless an objective criterion for assessing test results can be explicitly described.

(d) Subsequently, the Department will make the final determination and complete documentation on reasons for values or settings that deviate from EPA or FLM preferred values or settings.

3. Meteorological model data will be used, but not via the NOOBS pass through option of Calmet. The Department is in the midst of assembling NWS hourly surface observations for years 2004 through 2008. The compiled data will be used for PSD Class II area modeling. The network of NWS stations in compiled data will be expanded for 2006 through 2008 to include and extend at least 50 km beyond the domain for Class I area modeling. It will prepare the list of identifiers and coordinates for these stations as Calmet input and Calmet-ready input files containing the surface observations. And, it will prepare documentation of the sources of the surface data, any substitution for any missing data, and the construction of the data files.

4. The Department will prepare new Calmet-ready files for 2006 through 2008 hourly precipitation from NOAA/NWS archives. The domain of these stations will be the same as the domain for NWS surface and rawinsonde stations. It will prepare documentation of the data in these files and the construction of these files.

5. The Department will prepare new Calpuff-ready files for 2006 through 2008 hourly ozone data obtained at ambient monitoring stations within the Calmet domain. It will prepare documentation of station identifiers and coordinates, the Calpuff-ready ozone data file, and the construction of this file.

6. The Department has prepared surface terrain (elevation) data and land use data on a 3-km grid scale in Calmet-input-ready files. The Calmet-Calpuff domain size may be increased eastward so as to include most of North Dakota; if so, the surface terrain and land use data will be revised. Documentation as necessary to explain the sources of terrain and land use data will be prepared.

7. Using ammonia data from its Beulah monitoring site, the Department will prepare monthly average ammonia background concentrations for 2006 through 2008 for use with Calpuff. Procedures for developing the monthly averages will be documented.

8. An inventory of mobile sources' sulfur dioxide emissions will not be completed. While sulfur dioxide emissions of these sources likely decreased since the PSD minor source baseline date, construction of current period and baseline inventories are challenging and highly uncertain due to a scarcity of needed data. A written explanation will be prepared.

9. The Department will update the inventory of sulfur dioxide emissions by the flares and treaters in oil and gas production to year 2008. Prior inventories were completed for years 2000 (which was used in the *MOU Protocol*) and 2006. As with prior inventories, the 2008

inventory will include only flares and treaters located within 50 km of PSD Class I areas. It will use either the 2006 or the 2008 inventory when modeling each of the three years, 2006 through 2008, of meteorological, ozone and other emissions input data.[20] The Department will prepare documentation for construction of this inventory and Calpuff-ready input files.

10. The Department will prepare a year-by-year inventory of major source sulfur dioxide emissions for years 2006 through 2008 that will replace the existing 2000 through 2002 inventory. This new inventory will include all major sources throughout central and western North Dakota, including those near Sydney, MT and Estevan, SK. The Department will prepare documentation of the source characteristics data needed as input data for the Calpuff model.

a. Sources that were operating during one or more of the years 2006 through 2008 will be included in model performance demonstrations, which compare model-estimated concentrations to actual ambient concentrations, and in modeling for potential cumulative consumption of PSD increments. Permitted sources that have no history of sulfur dioxide actually emitted and proposed new sources in active NSRs will not be included in model performance demonstrations.

(1). The Department will use hour-by-hour continuous in-stack emissions monitoring (CEM) data, which are sulfur dioxide data actually emitted, for all sources where such data are available. The highest CEM values actually observed will not be modeled for all hours, because: a) the values for the remaining hours are less than the highest values, b) the highest values likely did not occur during meteorology conducive to the worst-case actual ambient concentrations,[21] and c) the highest values of respective sources do not occur concurrently.[22] Instead, it will use hour-by-hour CEM data paired with the hour-by-hour meteorological data. [23] This method will pair the highest sulfur

[20] Prior 2004-05 modeling of oil-gas production's flare and treater sulfur dioxide emissions for year 2000 illustrated that oil-gas production caused significant contributions to sulfur dioxide concentrations on some days in TRNP. See the Department's *Responses to Recurring Issues Related to North Dakota's Computer Modeling of Sulfur Dioxide in CAA PSD Class I Areas*, Attachment C.

[21] Most major sources of sulfur dioxide are located east or southeast of the state's PSD Class I areas; the largest model-estimated concentrations often occur southeast of these sources, rather than west or northwest of these sources. See also the Department's *Responses to Recurring Issues Related to North Dakota's Computer Modeling of Sulfur Dioxide in CAA PSD Class I Areas*, § 4.3.

[22] The emissions of North Dakota's coal-fired electric utilities during some months are greater than the emissions during other months, and the combined hour-by-hour CEM emissions are substantially less than the sum of highest CEM emissions for the respective units of all utilities. See, for example, the Department's *Supplemental Comments on EPA's Proposed Rule Revisions*, figures 1 and 2. This document is number 1280.2 in EPA docket number EPA-HQ-OAR-2006-0888.

[23] Back in 1999, EPA's Region 8 stated: "While, in general, the approach outlined in the [draft 1990 New Source Review Workshop] manual would provide a good estimate of both increment expansion and consumption, it appears that your situation is a special case because of the high variability of emissions

dioxide actually emitted with the meteorology that actually occurred that hour. The Department will prepare documentation describing these data. [24]

(2). Where hour-by-hour CEM data are not available for operating sources because CEM systems were inoperative, those periods of missing CEM data will be filled a) per 40 CFR Part 75, Subpart D, "Missing Data Substitution Procedures" or b) as "actual emissions" rates (see 40 CFR 51.166.b.21) computed from available CEM data for each year (i.e., 2006, etc.). However, no substitutions for hourly CEM data with "actual emissions" data will be made during hour-to-hour periods when sources were not operating. The Department will prepare documentation describing substitutions for missing CEM data.

(3). When operating sources do not have CEM systems, the annual (2006, etc.) "actual emissions" rates (see 40 CFR 51.166(b)(21)) of those sources will be used during hour-to-hour periods when these sources were operating. The Department will prepare documentation describing analyses of "actual emissions" rates.

11. No changes will be made to the *MOU Protocol's* Class I area Calpuff receptor networks. However, model receptors may be added external to Class I areas at 2 and 4 km (one and two network grid units) west, north, east and south so as to improve graphics of gradients of model-estimated concentrations and gradients of statistics of concentrations at individual receptors (e.g., second highest, mean, median or standard deviation) over the terrain of the networks. Modeled concentrations at these extra receptors will not be used as new

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from some of the largest major sources being modeled. In discussions with Kevin Golden, your staff indicated that the ratio of peak observed short term (3 and 24 hour average) to long term (annual) average emission rates, ranged from about 1.5 – 2.5 to one. Much of this variability occurs sporadically and appears to have a seasonal bias based on the sources operating level. The most accurate way to characterize the increment expansion (or consumption) from a source of this type would be to use continuous in-stack emission monitoring data from these sources in the dispersion modeling effort. These hourly data would be paired with meteorological data taken at the same time and used in the modeling. This method would take into account the effect of both emissions and meteorological variability." See letter dated June 1, 1999, from Richard Long, Director, Air and Radiation Programs, EPA Region 8, to Dana Mount, Director, Division of Environmental Engineering, North Dakota Department of Health. See also a memorandum dated July 30, 2008, from David Conroy, Chief, Air Programs Branch, EPA Region 5, to Linda Holst, Acting Deputy Director, EPA Region 5; this memorandum is document 1322.1 in EPA docket number EPA-HQ-OAR-2006-0888.

[24] This method departs from the Department's *MOU Protocol* where rule-defined "actual emissions" rates (see 40 CFR § 51.166(b)(21)) were used for all operating major sources. These rates are the total annual emissions during operating hours, or the average emission per operating hour. The Department twice tested the performance of both methods and found no significant difference in error and bias of modeled sulfur dioxide concentrations compared to actual ambient sulfur dioxide concentrations. See *North Dakota's SO2 PSD Air Quality Modeling Report*, Addendum C, § 6, and the Department's *Responses to Recurring Issues Related to North Dakota's Computer Modeling of Sulfur Dioxide in CAA PSD Class I Areas*, Attachment B. See also 72 FR No. 108 (June 6, 2007) 31372, §§ II.C and D, III, IV and V.

source design concentrations. A model receptor will also be placed at the location of each of the ambient air quality monitoring sites that will be used for model performance tests.

12. Customarily, a background concentration is added to model estimates of ambient concentrations when comparing the ambient concentrations to monitored concentrations. The background concentration represents near and far sources, such as mobile sources and oil-gas production sources, not explicitly modeled. Since mid-2007, the Department has been monitoring ambient sulfur dioxide at some locations using new technology monitors capable of detecting smaller concentrations. The Department will re-assess appropriate ambient sulfur dioxide background 24-hour and 3-hour concentrations for use in demonstrations of model performance. Other sources of information may be used, if applicable. A written report will be prepared.

B. Contracts for upper air meteorological data.

1. Data from NOAA's Rapid Update Cycle (RUC) meteorological model will be used as Calmet input;[25] NOAA has advanced the physics of the RUC model since 2002.[26] TRC's Atmospheric Studies Group has archived RUC data. Unless other arrangements occur, the Department will sponsor and contract for work by TRC or another firm to assemble RUC data for years 2006 through 2008, including substitutions for missing RUC data, in a ready-to-use and Calmet compatible format. The use of three years of meteorology follows EPA's *Guideline on Air Quality Models*, § 8.3.1.d. The RUC data domain will be as large as the NWS surface (task A.3) and rawinsonde station domain. This work will include documentation of construction of the Calmet-ready RUC data files, including data sources and methods for substitution of missing raw RUC data. The contract will require the documentation and Calmet-ready RUC data files without restriction on use.

2. The RUC data will not be applied via the NOOBS pass through option of Calmet. Unless other arrangements occur, the Department will sponsor and contract for work by TRC or another firm to obtain 2006 through 2008 rawinsonde data collected by the NWS at these locations: Bismarck ND, Glasgow MT, Rapid City SD, Aberdeen SD, International Falls MN, and Minneapolis-St. Paul MN. The contractor will prepare a list of identifiers and coordinates

[25] A demonstration that compared RUC data and Meteorological Model (MM5) data to independent wind-energy wind-tower data collected in western North Dakota illustrated that RUC data were more accurate than MM5 data. See a summary in the Department's *Responses to Recurring Issues Related to North Dakota's Computer Modeling of Sulfur Dioxide in CAA PSD Class I Areas*, § 5.2. Reasons as to why RUC data are more accurate can be found in: See *Comments on Upper Air Interpolation Shortcomings*, by Dennis Moon, WindLogics, Inc., (formerly SSESCO) in attachment 6 under Tab B in Vol. 3 of Exhibit 95 in the Department's periodic review hearings docket; *A Comparison of NOAA RUC Analysis Surface Winds and ADAS-Enhanced RUC Analysis Winds with Surface Observations*, pages 1 – 5, by WindLogics, Inc., St. Paul MN, and dated August 27, 2004; *RUC Analysis-based CALMET Meteorological Data for the State of North Dakota* , pages 1 – 4, by WindLogics, Inc., and dated August 24, 2004.

[26] http://ruc.noaa.gov/

for these stations as Calmet-ready input, a file or files of all raw rawinsonde data and a Calmet-ready input file containing the rawinsonde observations. And, it will prepare standalone documentation of the sources of the rawinsonde data, methods for substitution of missing rawinsonde data, and the construction of Calmet-ready data files.

Phase II – Performance Testing of Input Data for the *2009 Protocol*.

Estimated time line: two or three months.

1. Following completion of all Phase-I Calmet and Calpuff input data and of the documentation of these data, the Department will execute these models using that data.

2. In addition, the Department will execute the models by substituting the current (August 31, 2009) EPA and FLM preferences for the values or settings for Calmet execution control variables.[27] (Testing with a grid scale of 4 km instead of a grid scale of 3 km may not be conducted. Topography and the grid scale will be addressed at Phase I, task A.2.) And, the Department will complete one execution that incorporates EPA's recent (2006) preference for dispersion by Calpuff as well as EPA and FLM current (2009) preferences for Calmet. An execution of Calpuff using peak sulfur dioxide emission rates will not be completed. Chosen EPA and FLM values and settings for these model executions will be documented.

3. The mere availability of models, input data, and techniques combined in a protocol does not infer that the protocol is robust and its execution results in realistic model-estimated concentrations.[28] Following tasks 1 and 2, the Department will conduct statistical comparisons of the model-based estimates of sulfur dioxide concentrations from each task with actual ambient sulfur dioxide concentrations at five monitoring locations. The five locations are rural Hannover, rural Dunn Center, TRNP-SU, TRNP-NU and LWA.[29] These statistical analyses,

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[27] See EPA's Memorandum on the subject "Clarification on EPA-FLM Recommended Settings for CALMET," by Tyler J. Fox, Group Leader, Air Quality Modeling Group, OAQPS, and dated August 31, 2009. The preferences of EPA and FLMs in the EPA August 31, 2009, memorandum for the values or settings of Calmet execution control variables were based on tests of Calmet and Calpuff using data on transport and dispersion of inert tracer gases* released at locations that were not near or in North Dakota. (* See, for example, EPA's *Guideline on Air Quality Models* (70 FR (November 9, 2005) 68218), § 6.1.c, and EPA's *A Comparison of Calpuff Modeling Results to Two Tracer Field Experiments*, document EPA-454/R-98-009 dated June 1998.)

[28] See footnotes 13, 15, 16 and 27.

[29] Far-field transport, dispersion and depletion of sulfur dioxide occur after and depend on near-field transport, dispersion and depletion. For example, field monitors of actual ambient sulfur dioxide concentrations measure the residual air-borne sulfur dioxide, after plume dilution (transport and dispersion), due to plume depletion (i.e., deposition and chemical transformation of sulfur dioxide to sulfate*). So, Calpuff algorithms must collectively adhere to the law of conservation of mass, and Calpuff-estimated sulfur dioxide concentrations depend on algorithms for plume depletion. (*The half-life of sulfate is greater than the half-life of sulfur dioxide; so, it's likely the ratio of mass of sulfate to

including Pearson correlation, mean error, mean bias and mean normalized bias, will be documented.[30]

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sulfur dioxide at downstream places in plumes increases as plumes age after sulfur dioxide is emitted by a source.)

The rural Hannover and rural Dunn Center monitoring sites are often in the plumes of sulfur dioxide of tall industrial stacks during episodic events of the largest sulfur dioxide concentrations in TRNP. See *North Dakota's SO2 PSD Air Quality Modeling Report*, Addendum C, Appendix B, and Addendum D (*Synoptic Analysis of Episodic Easterly Wind Events in Central-Western North Dakota for the Years 2000 – 2002*), which prepared by WindLogics, Inc., for the Department.

Therefore, the Department reasons that its actual ambient sulfur dioxide concentrations are suited better than inert gases (see footnote 27) to assess the performance of a Calmet and Calpuff protocol that estimates those ambient concentrations due to the sources of sulfur dioxide in and near the central and western North Dakota region. At minimum, analytical demonstrations of model performance apply at the locations of the monitors. Many model receptors will be used in the South and North Units of TRNP and in the LWA. So, the demonstrations may include statistics of the receptor-to-receptor variability of model-estimated concentrations in Class I areas.

[30] Previous statistical results that were based on the *MOU Protocol* illustrated significant error and significant positive bias in model-based estimates of sulfur dioxide concentrations due to emissions of operating sources. For example, see the Department's *Responses to Recurring Issues Related to North Dakota's Computer Modeling of Sulfur Dioxide in CAA PSD Class I Areas*, § 5.8. When bias is positive, model-based concentrations are larger than monitored concentrations. When bias is negative, model-based concentrations are smaller than monitored concentrations. A positive bias assures protection of public health and environmental resources; however, there has been no bright line between acceptable and excessive positive bias.

True model performance and accuracy hasn't mattered to air quality management decision makers when modeled results that are based upon conservative modeling techniques and input data illustrated attainment of NAAQS or PSD increments. However, true performance and accuracy does matter when model inputs are overly conservative and modeled results illustrate possible or potential non-attainment of NAAQS or PSD increments.

CAA § 165(e)(2) and *Alabama Power* (footnotes 15 and 16) provide criteria that can lead to a conclusion as to whether a particular modeling protocol provides realistic results and, therefore, enforceable results. These criteria have been ignored by EPA and FLMs, as experienced by the State and the Department.

Realistic results are ill-defined because uncertainty in results, which is caused by uncertainty in modeling techniques, models and model input data, cannot be eliminated. But, a conclusion that results are realistic generally relies on confidence that the modeling techniques and model input data reflect legal criteria (e.g., footnotes 4, 5, 7, 15, and 16) and science that is appropriate for the modeling domain. Even then, it is possible that: a) error or bias can be similar in the magnitude of, or larger than, the highest monitored short-term concentrations such as those in TRNP (Attachment A); b) error or bias can be similar in the magnitude of, or larger than, a PSD Class I area short-term increment; or c) the largest of new source contributions in a NSR to model-based estimates of cumulative short-term concentrations can exceed a SIL but yet be less than error or bias. Any one of these circumstances casts doubt over a protocol as an effective tool for air quality management.

4. If statistical analyses reveal that input data for the *2009 Protocol* (Phase I) cause model-based sulfur dioxide concentrations that are less than actual ambient sulfur dioxide concentrations (negative bias), the Department will consider adjustments to settings for Calmet and/or Calpuff execution control variables, or other input conditions, which might improve the agreement between modeled and actual concentrations. The scientific credibility of such adjustments (as well as the definition of satisfactory model performance) will be addressed through consultation with an independent peer. Additional performance accuracy testing will be conducted to determine whether adjustments reverse the negative bias to a positive bias. If so, the input data for the *2009 Protocol* may be modified to accept the adjustments to Calmet and/or Calpuff user settings, or other input conditions. (Excessive positive bias is addressed at Phase V.2.) The consultations and performance accuracy testing will be documented.

5. The Department will complete a review of the status of sulfur dioxide PSD Class I area 24-hour increment consumption. This review will not be model based, but instead will use sulfur dioxide monitoring data; these data reflect emitted sulfur dioxide from all near and far, short stack and tall stack, sources. [31] The Department will prepare a written description and discussion of this review.

a. The review will use coal and oil production data and ambient sulfur dioxide monitoring data. The coal and oil production data are available for a historical period predating the sulfur dioxide PSD minor source baseline date, which is December 19, 1977, for central and western North Dakota. There are no ambient monitoring data prior to 1980; but data are available from 1980 for the TRNP-SU and the TRNP-NU. Coal and oil production data will be used in trend analyses to estimate a sulfur dioxide PSD 24-hour baseline concentration for each unit.[32]

See also footnotes 7, 10, 11, 13, 14, 21, 22, 27 and 29 and *North Dakota's SO2 PSD Air Quality Modeling Report,* Addendum C, § 10.1.

[31] Back in 1978, EPA acknowledged a role for ambient monitoring in tracking attainment of NAAQS and PSD increments. "As noted, EPA intends that monitoring should generally focus on obtaining data necessary for required review against NAAQS. Although the increment consumption [by new sources] must of necessity be tracked through the use of modeling, EPA does not intend that there be no real world checks on the accuracy of modeling. If a source or other party believes that the recommended models have either overpredicted or underpredicted the air quality impact of a source, the State may accept the submission of data which will more precisely define the impact of the source." See 43 FR No. 188 (June 19, 1978) at pages 26380, 26382. See also footnote 15.

[32] EPA admits an annual trend in peak ambient sulfur dioxide concentrations. In 2002, it stated: "…, the monitored data show a large decrease [SIC] in SO2 concentrations at Theodore Roosevelt National Park-North Unit in the two years preceding the peak concentrations measured in 1982. If that trend had continued back to the 1977 time period, coincident with the reduced oil production, concentrations in the 1976 to 1977 baseline period would have been lower than those monitored in 1980, or even in current years." See *EPA Comments on NDDOH's Proposed Determination Regarding the Adequacy of the SIP to Protect PSD Increments for Sulfur Dioxide*, pages 9 and 10. See also the Department's *Responses to Recurring Issues Related to North Dakota's Computer Modeling of Sulfur Dioxide in CAA PSD Class I Areas*, §§ 6.7 and 6.8.

b. The sulfur dioxide second-highest 24-hour and 3-hour ambient concentrations for 2006, 2007 and 2008 are shown in Attachment A. The differences between the current concentrations and sulfur dioxide PSD baseline concentrations, as determined by the preceding paragraph, will represent likely deterioration or improvement in sulfur dioxide concentrations after the baseline. These differences equate to potential cumulative consumption or expansion of the increments.

c. The potential future contributions to ambient concentrations by the future emissions of permitted sources that have no history of sulfur dioxide actually emitted and of proposed new sources in active NSRs will not be included in this review. And, no accounting of the contributions to ambient concentrations by sources granted Certifications of No Adverse Impact by FLMs will be attempted.

Phase III – Completion of the *2009 Protocol*.

Estimated time line: one month, some tasks are completed.

This phase addresses emission rates and other considerations for periodic and NSR modeling. Periodic review addresses the current status of consumption of PSD increments. NSR modeling builds on current consumption and adds the potential future consumption of PSD increments by non-operating sources. Note then that task 3 below, involving estimates of potential future emissions for non-operating sources, does not apply to periodic review modeling.

1. Source sulfur dioxide emissions inventories at PSD baseline (surrounding December, 1977) were completed during 2003-04. These inventories will be used along with Calmet output – from Calmet modeling at Phase II of the 2006-08 meteorological, 2006-08 ozone, 2006-08 ammonia and land use data – as Calpuff input to estimate sulfur dioxide short-term baseline concentrations at model receptors in PSD Class I area. Documentation of these inventories was completed during 2005;[33] this documentation will be updated, if necessary.

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[33] See *North Dakota's SO2 PSD Air Quality Modeling Report*, §§ 3.2 and 3.3, and Addendum B, Appendices D, E and F. The State also notes that: "The CAA reserved to each state discretion and authority to establish the baseline concentration by monitoring ambient concentration levels, and by making adjustments to the monitored baseline ambient concentration levels with computer modeling, after taking into account projected emissions from a source that had commenced construction but not begun operation by January 6, 1975, as well as actual emissions after the baseline date if a source can demonstrate that its operation after the baseline date is more representative of normal source operation than its operation preceding the baseline date." Id., § 2.0. See also N.D. Admin. Code § 33-21 15-15-01(a)(1); 40 CFR. § 51.166(b)(21)(ii); 40 CFR § 52.21(b)(21)(ii); 45 Fed. Reg. 52675, 52714 (August 7, 1980); *Alabama Power Co. v. Costle*, 636 F.2d 323, 372, 381, 387 (D.C. Cir. 1980); and EPA's *Prevention of Significant Deterioration Workshop Manual* (October 1980).

a. Meteorological, ozone and ammonia data are not available for years proceeding December 19, 1977, which is the sulfur dioxide PSD minor source baseline date for central and western North Dakota. The practice of using 2006-08 meteorological, ozone and ammonia data when modeling PSD baseline emissions, rather than 1976, 1977 or 1978 data, adds uncertainty into model-based assessments for consumption of the sulfur dioxide PSD increments.

2. Source sulfur dioxide emissions inventories for the current operating sources will be consistent with the year-by-year inventories (2006 through 2008) developed for performance testing in Phase I, tasks A.9 and A.10. However, Canadian source emissions will not be included.

3. The potential future emissions of permitted sources that have no history of sulfur dioxide actually emitted and of proposed new sources in active NSRs will be included in determinations for potential future cumulative consumption of sulfur dioxide PSD increments. These determinations will not include Canadian sources of emitted pollutants.

a. Permitted sources having no history of sulfur dioxide actually emitted will be modeled by using permit-allowed short-term peak emissions rates irrespective of the date the permit was granted.[34] References to documentation of these emission rates will be provided.

b. Proposed new sources in active NSR will be modeled by using engineering estimates of short-term peak emissions.[35] References to documentation of these emission rates will be provided.

4. The CAA PSD increments (§§ 163 and 165) provide allowable increases in ambient concentrations over baseline concentrations. No change will be made to the *MOU Protocol's* technique for calculating consumption of PSD increments.[36] Additional documentation in response to recurring issues was completed during 2007.

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[34] Emissions of industrial sources generally are not 24/7 constants, but instead vary hour-to-hour or day-to-day due to fuel quality and/or seasonally due to output demand. The practice of modeling the short-term peak rate of each of these sources (§ III.3.a) is overly conservative as it assumes that the actual short-term peak rate of each of these sources, once in operation, will concurrently converge: a) during hours of meteorology conducive to worst-case ground level concentrations, and/or b) during the hours of the actual short-term peak rate of each operating source. See also footnote 22.

[35] Similarly, this practice is overly conservative as it assumes that the actual peak rates of the proposed source (§ III.3.b) and the actual peak rates of each newly permitted source (§ III.3.a), once in operation, will concurrently converge: a) during hours of meteorology conducive to worst-case ground level concentrations, and/or b) during the hours of the actual short-term peak rate of each operating source.

[36] See *North Dakota's SO2 PSD Air Quality Modeling Report*, Addendum B, § 6.2. See also footnote 7 and *North Dakota's SO2 PSD Air Quality Modeling Report*, Addendum C, § 8.0.

a. The technique, as does EPA's technique,[37] assumes that the background concentration for modeled concentrations due to PSD baseline emissions is the same as the background concentration due to current period emissions. The background concentration represents near and far sources, such as mobile sources and oil-gas production sources, not explicitly modeled. When these background concentrations are the same, they cancel in the computations for consumption of increment. However, background concentrations might not have been the same between these time lines, nor were background concentrations likely the same among model receptors in PSD Class I areas, which causes additional uncertainty as to the accuracy of the model-based estimates of consumption of PSD increments.

5. Sources that have been granted Certifications of No Adverse Impact by FLMs will be modeled individually so that the contributions of these sources can be excluded, as allowed and intended by the CAA (§ 165), from a determination of the status of consumption of the sulfur dioxide PSD Class I area short-term increments.[38] However, the contributions of these sources cannot be excluded from a determination of the status of consumption of the alternate sulfur dioxide PSD Class I area short-term increments.

6. TRNP is comprised of three units, which are non-contiguous land areas.[39] Assessments of impacts by emitted sulfur dioxide and other emitted primary pollutants will respect each unit

[37] EPA's technique or policy was established during the early 1980s and included in its Guideline on Air Quality Models, § 10.2.3.3(b). A federal-state group of modelers concluded in a 2005 PSD Modeling Workshop report that: "The origin of this [technique as a] policy (later turned in to regulation [i.e., included in the Guideline]) appears to not be a conscious decision but rather a consequence of simplifying the PSD modeling and increment inventory requirements. That is, modeling only the increment affecting sources as positive and negative emissions [rather than both baseline and current emissions] in a Gaussian plume model implicitly makes a time and space calculation [at each model receptor]. Nevertheless, a reading of the CAA language related to baseline concentration and considering Congressional intent, the PSD calculation could arguably be interpreted as intended to be spatial only (a difference of maximums). The resolution of this interpretation is a policy issue that may, in fact, be largely settled just by virtue of the current policy's long standing." The report does not describe the consequence of using the EPA policy's technique compared to using the CAA's baseline concentration. The report admits that the EPA policy's technique may not conform to the CAA and recommends that the group: "Request that the EPA policy group reevaluate the consistency of the current policy with the CAA and Congressional intent and provide an analysis report making a final determination in writing."
See http://cleanairinfo.com/modelingworkshop/presentations/PSD_WG_Coulter.pdf.

[38] See *North Dakota's SO2 PSD Air Quality Modeling Report*, § 3.7, and Addendum H, and *Comments by the North Dakota Department of Health and the State of North Dakota on EPA'S Proposed Rule Revisions*, pages 26 through 50, in a letter by Terry O'Clair, Director, Division of Air Quality, NDDH, and dated August 6, 2007, to Stephen L. Johnson, EPA Administrator, Environmental Protection Agency, and *Supplemental Comments by the North Dakota Department of Health and the State of North Dakota on EPA'S Proposed Rule Revisions*, pages 35 through 43, in a letter by Terry O'Clair, Director, Division of Air Quality, NDDH, and dated September 28, 2007, to Stephen L. Johnson, EPA Administrator, Environmental Protection Agency.

[39] See 44 FR (November 30, 1979) at 69125 and 69127, 40 CFR § 81.423 and NDAC § 33-15-15-01.2 (Scope) relating to 40 CFR 52.21(e).

individually. This practice does not affect determinations for consumption of PSD Class I area increments because these determinations are made for each Calpuff receptor located within the units.[40]

Phase IV – EPA and FLM Review of the *2009 Protocol* and Performance Documentation.

Estimated time line: six weeks.

The Department will assemble and provide EPA and FLMs with copies of Phase I, II and III documentation for their review and comment.[41] The Department will consider conducting an oral briefing (e.g., one day workshop in Bismarck) on the documentation, if requested by EPA and FLMs. The Department will prepare a written summary of the briefing (workshop), if held, following the briefing.

Phase V – State, Department and Peer Review of EPA and FLM Comments.

Estimated time line: six weeks to three months. This phase runs concurrent with Phase IV but extends in time beyond Phase IV so as to include EPA and FLM comments from Phase IV.

1. The Department may arrange for an independent peer review of the work products of Phases I, II, III and IV as well as the work products of past recurring issues. Independent reviewers will be selected from administrative and technical experts in meteorological and air quality modeling such as: a state air quality program administrator, a representative of EPA's OAQPS, Air Quality Policy Division, a consultant of choice by the electric utility industry (and paid for by that industry), an atmospheric or air quality scientist affiliated with a

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[40] The cumulative contributions of sources to ambient concentrations are used to examine potential effects on PSD Class I area Air Quality Related Values. The Department assesses impacts on visibility or regional haze due to primary and secondary pollutant for each unit of TRNP, respectively. Federal regulation 40 CFR 51.301 states: ***"Adverse impact on visibility*** **means, for purposes of section 307, visibility impairment which interferes with the management, protection, preservation, or enjoyment of the visitor's visual experience of the Federal Class I area. This determination must be made on a case-by-case basis taking into account the geographic extent**, intensity, duration, frequency and time of visibility impairments **and how these factors correlate** with (1) times of visitor use of the Federal Class I areas, and (2) the frequency and timing of **natural conditions that reduce visibility**. This term does not include effects on integral vistas." (Emphasis added.) Additional discourse on this issue is outside the scope of this plan.

[41] EPA and FLM staff are bound, as is the Department, by: a) the same CAA, b) the same implementing regulations, c) the same preambles (dating back to 1974) to EPA's regulations, d) the same *Alabama Power* decision (and other decisions regarding arbitrary and unreasonable actions), e) North Dakota's EPA approved SIP, f) the same EPA *Guideline on Air Quality Models* (70 FR (November 9, 2005) 68218), and g) transparency and their own expectations of disclosure of the science applied by others through discretion in choosing and constructing model input data.

university, and an air quality modeler. Names of reviewers will not be revealed until all written reviews are received. If peer review is arranged, a written consensus document will not be required so as to reduce costs and constrain time lines. The decision to engage peer review will consider past recurring issues as well as the range and complexity of issues emerging during Phases I, II and III.

2. The State (Office of Attorney General) and the Department will review EPA and FLM comments on the *2009 Protocol* and the performance results as well as peer reviewer comments. If deemed prudent on advice by peer review, the Department may conduct one or more sensitivity tests or performance analyses for the purpose of illustrating the effect of data input options on modeled sulfur dioxide concentrations and on performance versus monitoring data.[42] Again, this work and the outcome will be described in a written document.

3. Applicants for air quality permits to construct can prepare applications per the *MOU Protocol* or per Phases I and III of this plan once these phases are completed. However, the Department will conduct NSRs of completed applications for air quality permits to construct on the basis of its findings at conclusion of Phase V, tasks 1 and 2.

Phase VI – Complete a New Periodic Review for consumption (or expansion) of the sulfur dioxide PSD increments on the basis of the Department's findings at Phase V.

Estimated time line: four to six weeks.

The Department will complete a new review of the status of consumption of the sulfur dioxide PSD short-term increments using the *2009 Protocol*. Model input data from Phases I and III, unless revised at Phase V, comprise the *2009 Protocol*. This review will include only sources' emissions compiled at Phase III, tasks 1 and 2; it will not include sources' emissions compiled at Phase III, task 3.

However, an assessment of the status of consumption of CAA PSD increments is normally completed by a permit applicant and included in its application.[43] The potential future

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[42] If by chance Phase II performance testing illustrates that, by using EPA and FLM preferred values or settings for model execution control variables, modeled concentrations provide as realistic or more realistic estimates of actual ambient concentrations when compared to the *2009 Protocol*, then the *2009 Protocol* may be revised. However, such an outcome from the test results merely confirms that either Calmet or Calpuff, or both, have uncertainty in the coded algorithms rather than provides a conclusion that EPA and FLM preferences are better suited for the topography, meteorology, source configuration and source characteristics in and surrounding central and western North Dakota. Under these circumstances, adopting EPA and FLM preferred values or setting for model execution control variables is akin to calibrating the models to achieve better agreement with monitoring data, which has been opposed by EPA and some others. See, for example, the Department's *Responses to Recurring Issues Related to North Dakota's Computer Modeling of Sulfur Dioxide in CAA PSD Class I Areas*, § 3.8.

[43] See footnote 17.

emissions of permitted sources that have no history of pollutants (i.e., sulfur dioxide, nitrogen oxides and particulates) actually emitted and of proposed new sources in active NSRs (Phase III, task 3), as well as the emissions of operating sources (Phase I, tasks A.9 and A.10), are included in determinations for potential future cumulative consumption of PSD increments.

The Department will also complete a review of the potential future cumulative consumption of PSD increments. In addition, Minnkota Power Cooperative, Inc., is obligated via a court-approved Consent Decree to upgrade system controls of sulfur dioxide emissions at its Milton R.Young station. The upgrades, which are underway, will reduce emitted sulfur dioxide approximately 20,000 tons per year beginning with year 2012.

Attachment A

The North Dakota Department of Health publishes annual reports of ambient monitoring data collected at its monitoring locations across the state. The second-highest 24-hour and 3-hour ambient sulfur dioxide concentrations at five locations for years 2006, 2007 and 2008 are shown in tables below. One part per billion (ppb) equals 2.62 micrograms per cubic meter ($\mu g/m^3$).

The sulfur dioxide PSD Class I area 24-hour increment is 1.92 ppb (5 $\mu g/m^3$), and the 3-hour increment is 9.54 ppb (25 $\mu g/m^3$). The sulfur dioxide Class II area 24-hour increment is 35 ppb (91 $\mu g/m^3$), and the 3-hour increment is 195 ppb (512 $\mu g/m^3$).

Second-highest 24-hour ambient sulfur dioxide concentrations. (ppb)

Station Location	PSD Class, Increment	2006	2007	2008
TRNP – SU	I, 1.92	2	2	2
TRNP – NU *	I, 1.92	2	2, 2.3	4.0
LWA *	I, 1.92	10	10, 6.4	8.0
rural Dunn Center *	II, 35	4	2, 2.3	3.0
rural Hannover	II, 35	7	11	8

* Monitors capable of detecting lower concentrations at greater accuracy replaced older monitors mid-2007. Two numbers are shown for 2007: the second-highest for the period of operation of the respective monitors.

Second-highest 3-hour ambient sulfur dioxide concentrations. (ppb)

Station Location	PSD Class, Increment	2006	2007	2008
TRNP – SU	I, 9.54	7	6	5
TRNP – NU *	I, 9.54	7	6, 10.2	12.0
LWA *	I, 9.54	25	30, 17.1	26.0
rural Dunn Center *	II, 195	16	8, 6.6	11.0
rural Hannover	II, 195	30	11	32

* Monitors capable of detecting lower concentrations at greater accuracy replaced older monitors mid-2007. Two numbers are shown for 2007: the second-highest for the period of operation of the respective monitors.